Triangle Universities Nuclear Laboratory

Detection & Isotopic Identification of Nuclear Materials Using a Mono−Energetic γ−Ray Beam

Henry R. Weller, M. Ahmed, B. Norum, D. McNabb, V. Litvinenko

Motivation & Possible Applications

- To provide data needed for the development of active gamma−ray interrogation.
- Examination of sealed waste barrels;
  Non−proliferation of special nuclear materials (SNM)

Approach

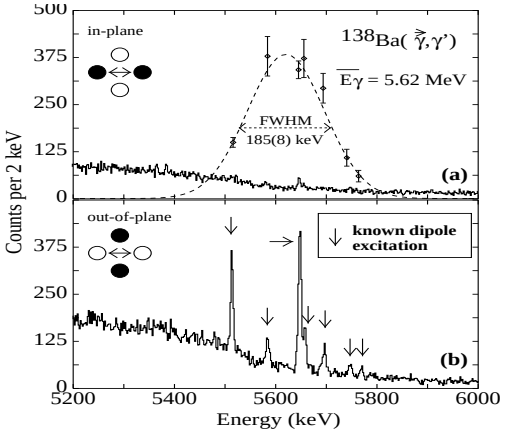
- Generate spectra of gammas and neutrons produced with HIGS beams incident on various isotopes (e.g. U and Pu) for incident energies from 5 to 14 MeV. Goal is to develop a pattern recognition code to identify isotopes in an arbitrary mixture.

Special Features

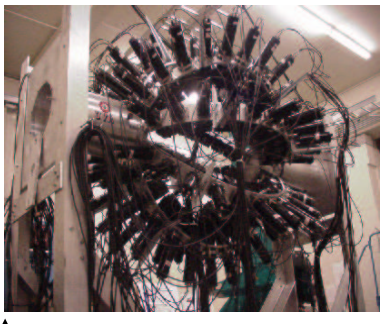
- Provides unique signatures for each SNM;
- Produces selective interations with nuclear materials with essentially no radio−activation of common substances;
- Very sensitive to minute quantities of SNM.

HIGS beams can be continuously varied in energy to create Nuclear Resonance Fluorescence (NRF) spectra for various isotopes as a function of beam energy. This can be used in a pattern recognition code.

Effectiveness of HIGS in NRF Measurements

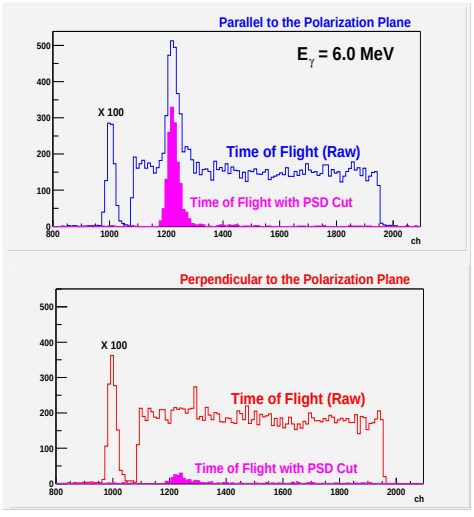


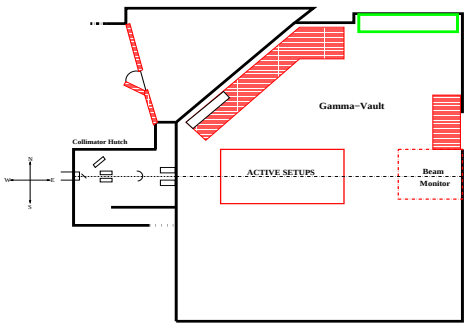
Additional reactions with larger cross−sections will also be employed. These include (γ,n), (γ,nγ), and (γ,fission) reactions. The HIGS beam aloows for background free measurements of the outgoing neutrons, including those from photo−fission, by making use of the pulsed nature of the beam.



Blowfish − An 88−neutron detector Array

The use of time−of−flight and pulse−shape−discrimination can eliminate all background →





The HIGS Target Room Setup

Contacts: mcnabb3@llnl.gov, ben@virginia.edu, weller@tunl.duke.edu, vl@fel.duke.edu, and ahmed@tunl.duke.edu